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(54) **ADJUSTMENT MECHANISM FOR PUMP SEAL**

(75) Inventor: **Gregory Craig Dewsnap**, Frimley (GB)
(73) Assignee: **Linatex Limited**, Lancashire (GB)
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See application file for complete search history.

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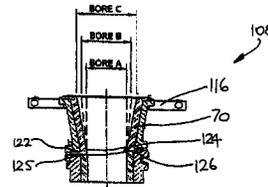
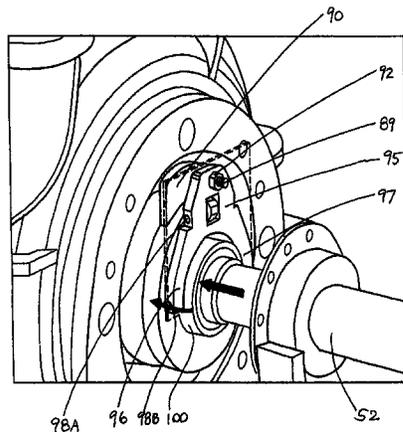
Primary Examiner — Gilbert Lee

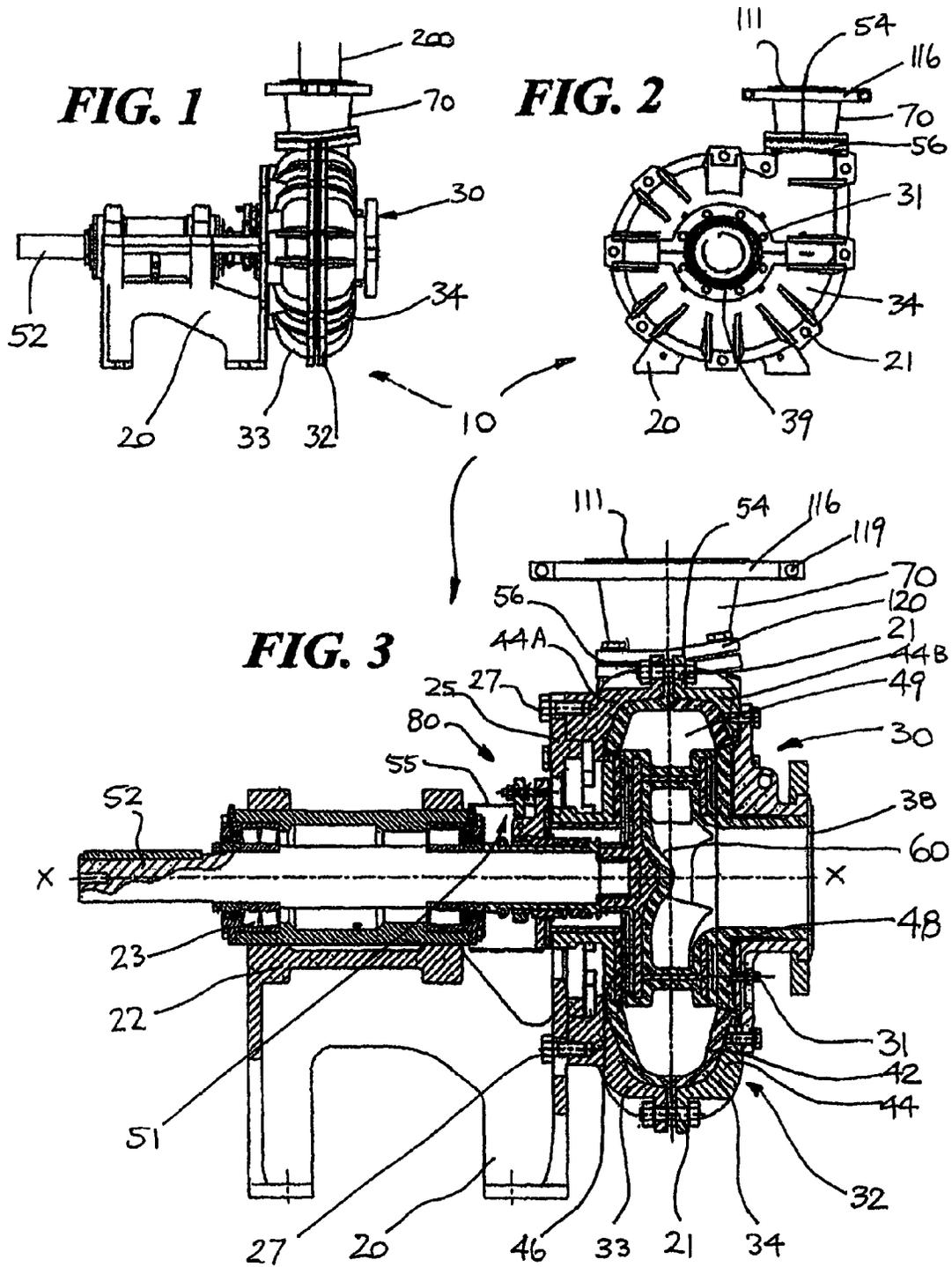
(74) *Attorney, Agent, or Firm* — Gardere Wynne Sewell LLP

(57) **ABSTRACT**

An adjustment mechanism (85) for a seal assembly (80) for a pump drive shaft (52) of a pump, the pump shaft (52) mounted for rotation about a rotation axis. The seal assembly (80) comprises a rotating seal (81) mounted for rotation with the drive shaft (52) about the rotation axis and a static seal (84) adjacent the rotating seal (81) and axially moveable relative thereto. The adjustment mechanism (85) comprises an adjustment member (87) which is axially moveable so as to cause axial movement of the static seal (84) relative to the rotating seal (81). The mechanism further includes an actuator (88) and a transmission (93) for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator. The transmission (93) is operatively connected to the adjustment member (87) at two spaced apart couplings (98) whereby activation of the actuator causes simultaneous transmission of the motive force to the two spaced apart couplings. The actuator (88) is disposed externally of all pump parts.

28 Claims, 7 Drawing Sheets





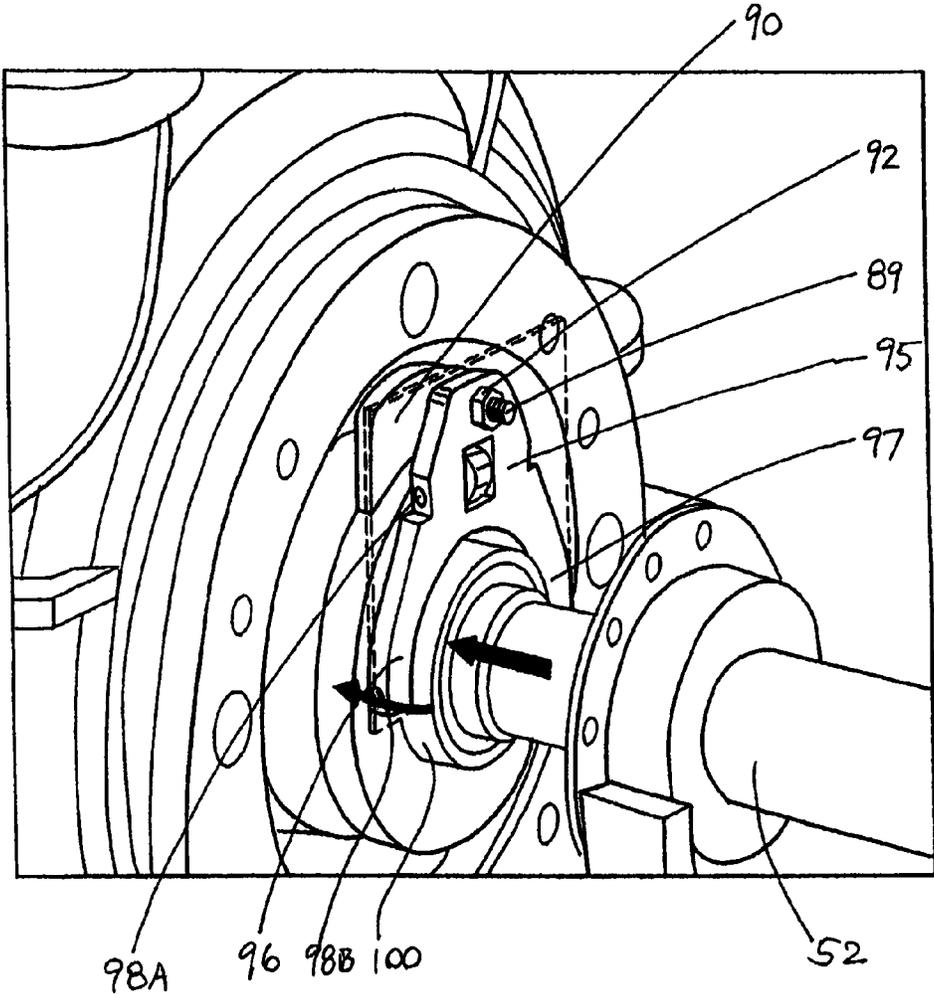


FIG. 5

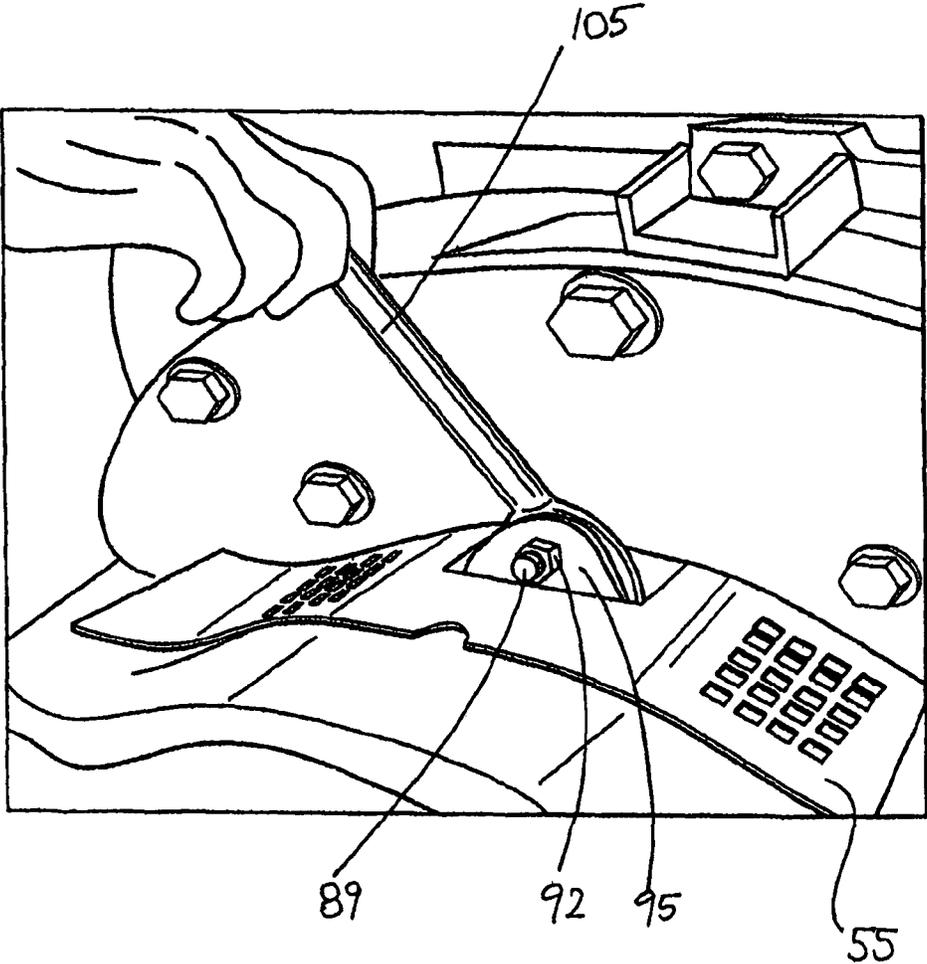


FIG. 6

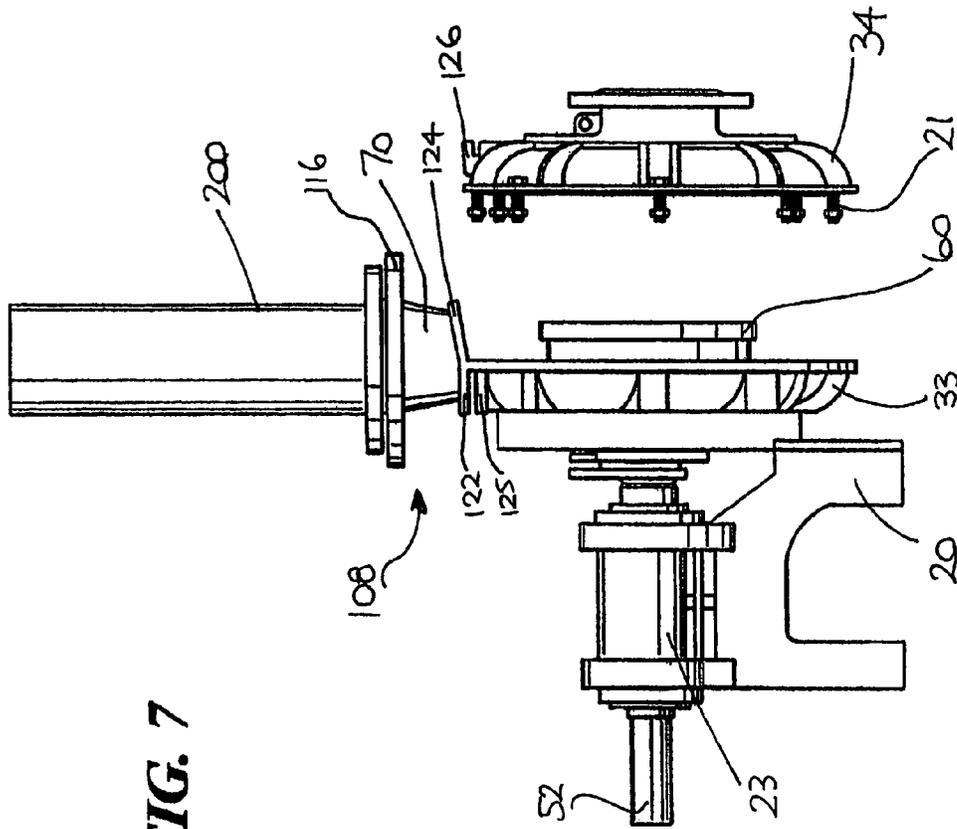


FIG. 7

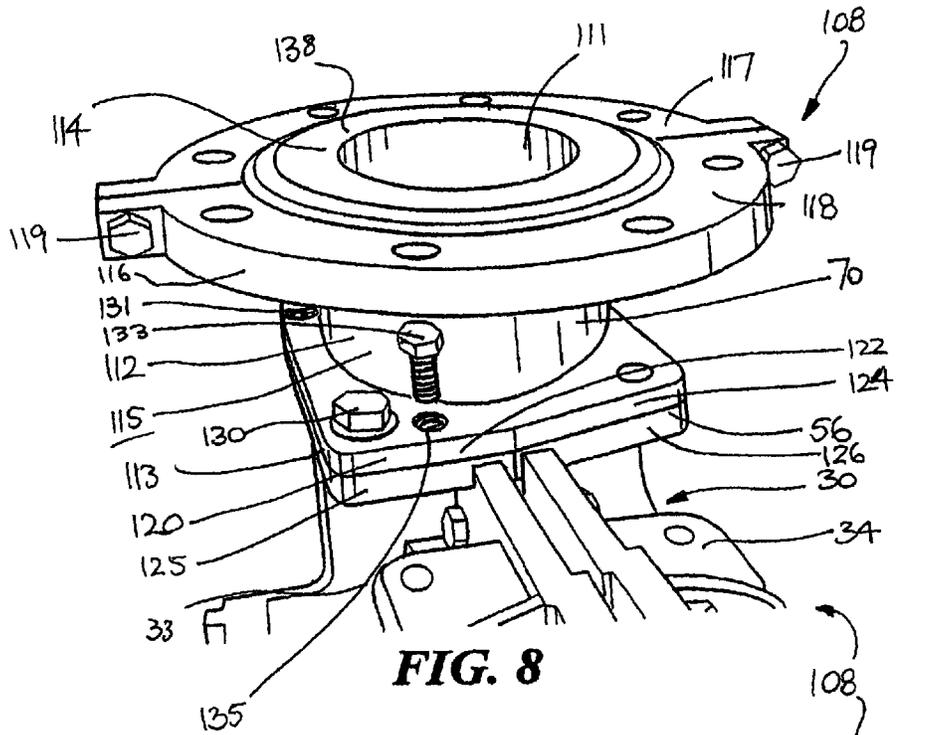


FIG. 8

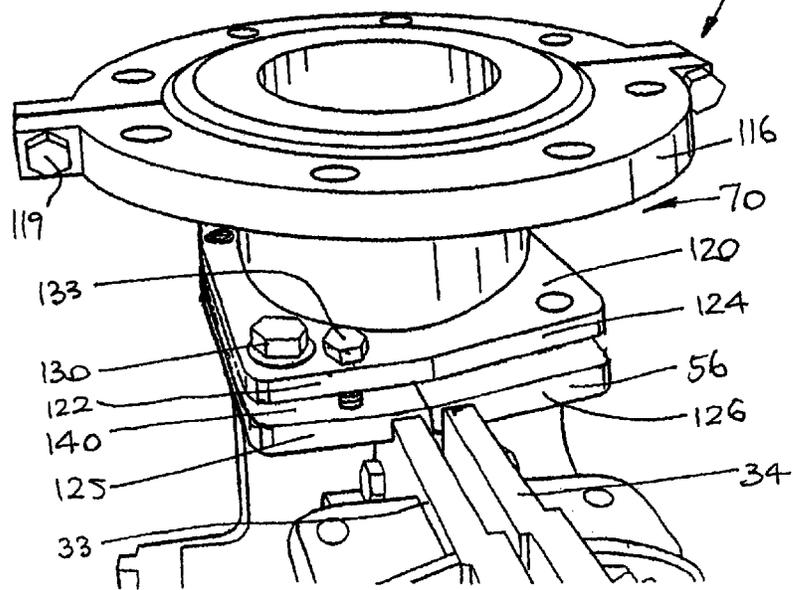


FIG. 9

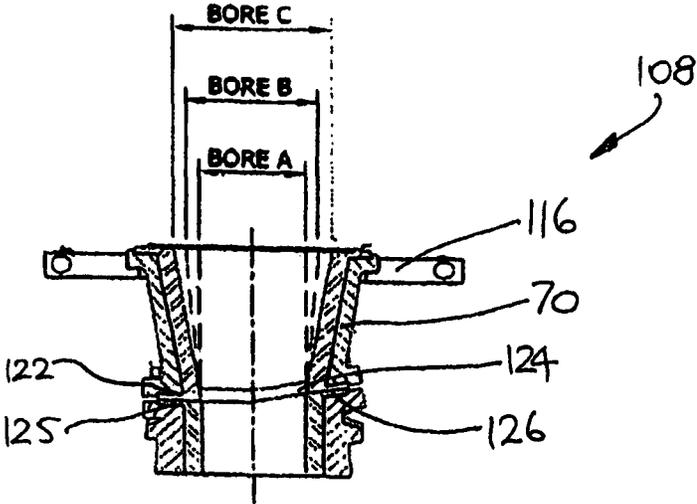


FIG. 10

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ADJUSTMENT MECHANISM FOR PUMP SEAL

TECHNICAL FIELD

The disclosure relates generally to pumps and more particularly to seal assemblies therefore and to components for pump seal assemblies.

BACKGROUND ART

Pumps of the centrifugal type generally comprise a pump housing the interior of which forms a pump chamber. An impeller is positioned in the pump chamber and is connected to a drive shaft and drive motor that impart rotation to the impeller. The pump housing is formed with an inlet for receiving pumped material into the pump chamber, and a discharge outlet through which pumped material exits the pump chamber.

Seal assemblies are required to provide fluid barriers between various pump parts. One example of such seal assemblies is of the type used to seal the entry region of the drive shaft into the pump chamber. In one form of known seal assembly of this type the assembly comprises a rotating seal member which is mounted for rotation with the drive shaft and a static seal member which is adapted to bear against the rotating seal in order to provide an effective seal between the pump chamber and the drive shaft. Seal assemblies of this type are often referred to as gland seals. In this type of seal the sealing faces between the rotating and static seal members are lubricated and cooled by a small leakage of fluid between the seal members.

In order for the seal assembly to operate properly careful alignment and adjustment of the position of the seal members must be done for correct initial set up and maintenance and further adjustment when the pump is operating (dynamic adjustment). Incorrect location of the two seal members can result in seal failure as a result of lack of lubrication of the sealing faces.

SUMMARY OF THE DISCLOSURE

In one aspect there is provided an adjustment mechanism for a seal assembly for a pump drive shaft of a pump, the pump shaft mounted for rotation about a rotation axis, the seal assembly including a rotatable seal mounted for rotation with the drive shaft about the rotation axis and a static seal adjacent the rotatable seal and axially moveable relative thereto, the adjustment mechanism comprising an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, an actuator and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member at one or more couplings(s) whereby activation of the actuator causes simultaneous transmission of the motive force to the or each couplings.

In certain embodiments, the one or more coupling(s) can comprise at least two spaced apart couplings.

In certain embodiments, the adjustment member can include an adjustment sleeve, which is mounted substantially coaxially with respect to the drive shaft in an assembled position and axially movable relative thereto, the static seal being operatively mounted to one end of the adjustment sleeve.

In certain embodiments, the adjustment mechanism can further include a mounting member secured to the other end

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of the adjustment sleeve, the spaced apart couplings being on the mounting member. In certain embodiments the mounting member can comprise a ring secured to the other end of the adjustment sleeve. In certain embodiments the spaced apart couplings can be pivot mountings disposed on opposite sides of the adjustment sleeve.

In certain embodiments the transmission can comprise a fork shaped member having two spaced apart legs extending away from one end of the fork shaped member the free end of each of the legs being pivotally connected to a respective one of the two spaced apart couplings the member being mounted for pivotal movement in a region between the end of the fork shaped member and the free ends of the spaced apart legs, the one end of the fork shaped member being associated with the actuator.

In certain embodiments the actuator when fitted can be spaced from the drive shaft and external of all pump parts.

In a second aspect, there is provided an adjustment mechanism for a seal assembly for a pump drive shaft of a pump, the pump shaft mounted for rotation about a rotation axis, the seal assembly including a rotatable seal mounted for rotation with the drive shaft about the rotation axis and a static seal adjacent the rotatable seal and axially moveable relative thereto, the adjustment mechanism comprising an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, an actuator and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member whereby activation of the actuator causes simultaneous transmission of the motive force to the adjustment member, the actuator being spaced from the drive shaft and external of all pump parts when fitted.

In a third aspect, there is provided a seal assembly for a pump drive shaft of a pump, the seal assembly including a housing having a seal chamber therein arranged so that when fitted the drive shaft extends through the pump chamber and an adjustment mechanism as described above the rotatable seal and static seal being disposed within said seal chamber and the adjustment member being at least partially received within the seal chamber.

In a fourth aspect, there is provided a method of adjustment for a seal assembly as described above, the method including the step of activating the actuator to cause relative movement between the rotatable and static seal members.

In certain embodiments, the method of the third aspect may include a first step being a coarse adjustment step and a second step being a fine adjustment step effected by the actuator.

BRIEF DESCRIPTION OF THE DRAWINGS

Notwithstanding any other forms which may fall within the scope of the methods and apparatus as set forth in the Summary, specific embodiments will now be described, by way of example, and with reference to the accompanying drawings in which:

FIG. 1 is a schematic side elevation of an embodiment of a pump apparatus;

FIG. 2 is a schematic end elevation of the pump apparatus shown in FIG. 1;

FIG. 3 is a sectional side view of the pump apparatus shown in FIG. 1;

FIG. 4 illustrates a schematic sectional view of an adjustment mechanism of the pump apparatus shown in FIGS. 1 to 3;

FIG. 5 is a perspective view of part of the adjustment mechanism shown in FIG. 4;

FIG. 6 is a perspective view illustrating how adjustment of the adjustment mechanism that is shown in FIGS. 4 and 5 can be effected;

FIG. 7 is a side elevation of the pump apparatus shown in FIGS. 1 to 6 illustrating an adaptor;

FIG. 8 is a detail perspective view of the adaptor shown in FIG. 7 in a first position in relation to the rest of the pump apparatus;

FIG. 9 is a sectional side elevation of the adaptor shown in FIG. 7 in a second position in relation to the rest of the pump apparatus; and

FIG. 10 is a sectional side elevation of the adaptor shown in FIGS. 7 to 9.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

Referring to the drawings, in particular to FIGS. 1 to 3, there is illustrated a pump assembly 10 having a pump housing support 20 (often referred to in the pump industry as a pedestal or frame) to which is attached a pump housing 30. As illustrated in FIG. 3 the pump housing 30 generally comprises an outer casing 32 which comprises two side casing parts 33, 34 (sometimes also known as the frame plate and the cover plate, respectively) which are joined together about a periphery of the two side casings parts 33, 34 by bolts 21. The side casing part (or frame plate) 33 is mounted to a mounting ring 25 which forms part of the housing support 20 by means of bolts 27. The housing support 20 includes a shaft bearing mounting section 22 for receiving a shaft bearing cartridge 23 thereon. A drive shaft 52 is supported by the bearing cartridge 23 and extends into pump chamber 49 through a seal assembly 80 and a side opening in the side casing part (or frame plate) 33. An end cover plate in the form of a generally circular disc 39 is secured to the centre of the side casing part (or cover plate) 34 by bolts 31.

The pump housing 30 further comprises a pump housing inner liner 42 arranged within the outer casing 32 and which includes a main liner (or volute) 44 and two side liners 46, 48. The side liner (or back liner) 46 is located nearer the rear end of the pump housing 30 (that is, nearest to the pedestal or base 20, and also adjacent to the frame plate 33), and the other side liner (or front liner, also sometimes known as the throat bush) 48 is located nearer to the front end of the pump housing 30 and adjacent to the cover plate 34 and the circular disc 39.

In the embodiment shown, the main liner (or volute) 44 is comprised of two separate sections 44A, 44B (made of such material as rubber or elastomer) which are assembled within each of the side casing parts 33, 34 respectively and brought together when the pump housing 30 is assembled to form a single main liner 44, although in some embodiments the main liner (or volute) 44 may be made in one-piece and which may, for instance, be made of metal or ceramic material.

When the pump is assembled, side openings in the volute 44 are arranged to receive the two side liners 46, 48 to form a continuously-lined pump chamber 49 which is disposed within the pump outer casing 32. During use, fluid enters the pump chamber 49 through an inlet port 38 and is discharged through an outlet port 54 in the discharge outlet 56. A seal assembly 80 is disposed adjacent the side liner (or back liner) 46 and is arranged with various components to prevent leakage of fluid from the pump chamber 49 during use. Between the seal assembly 80 and the bearing cartridge 23 there is an access zone 51 which is at least partially surrounded by a guard or cover 55 in the form of a screen or mesh to prevent

injury to a body part of a worker who may come into contact with any moving parts of machinery located at the back of the pump housing 30.

An impeller 60 is positioned in the pump chamber 49 within the volute 44 and is mounted to the drive shaft 52, which has a rotation axis X-X. A drive (not shown) is operatively connected to the drive shaft 52, in the region of the pedestal or base 20, and remote from the pump housing 30. The rotation of the impeller 60 causes the fluid (or solid-liquid mixture) that is being pumped to pass from a pipe which is connected to the inlet port 38, through the pump chamber 49 which is defined by the volute 44 and the side liners 46, 48, and then out of the pump chamber 49 via the discharge outlet port 54. The discharge outlet port 54 is arranged in the discharge outlet 56 portion of the pump housing 30. The discharge outlet 56 is operatively connected to adjacent pipe-work 200 via an adaptor 70 which will be described in detail hereinafter.

The seal assembly 80 is best understood with reference to FIGS. 4 to 6. The seal assembly 80 comprises a rotating seal in the form of a circumferential ring 81 which is operatively mounted for rotation with the drive shaft 52. A shaft sleeve or gland sleeve 82 overlies the drive shaft 52 and is arranged to rotate therewith. The rotatable ring seal 81 is mounted on one end of the gland sleeve 82. The rotatable ring seal 81 is in the form of a flexible ring and may be formed from an elastomer, such as rubber. The seal assembly 80 further includes a static ring seal 84 (that is, a non-rotatable portion of the seal assembly 80) which in use is disposed in a close-facing relationship adjacent to the rotatable ring seal 81. The static ring seal 84 is in the form of a ring made from a hard material such as silicon carbide, which provides for a hard wearing face which can abut against the rotatable ring seal 81. The static ring seal 84 is mounted to an adjustment sleeve 87 which forms part of an adjustment mechanism 85 which is described in detail hereinafter. The adjustment sleeve 87 is slidably mounted for axial movement so that the static ring seal 84 can be moved towards or away from the rotatable ring seal 81. The adjustment sleeve 87 is mounted coaxially around the shaft or gland sleeve 82. A gland seal 78 is positioned between the seal housing 90 and the adjustment sleeve to provide a packing to prevent the leakage of any process fluid from the pump chamber 49 in use.

The adjustment mechanism 85 comprises an actuator 88 in the form of a stud 89 threadedly mounted into the seal housing 90. Two nuts 91 and 92 are threadedly received on the stud 89 for movement relative thereto, and each nut is located on an opposing side of a forked member 95 which is also positioned with the stud 89 extending therethrough. These nuts 91, 92 function to lock the forked member 95 in a particular position in relation to the stud 89. A transmission arrangement 93 is best seen in FIG. 5, incorporating these components. The forked member 95, which is in the form of a body arranged with two spaced-apart legs 96, 97 extending therefrom, is operatively connected between the actuator 88 and the adjustment sleeve 87. The forked member 95 is pivotally mounted at a pivot 98A and has one end secured to the stud 89 which extends therethrough and between the nuts 91 and 92. The ends of each leg 96 and 97 are pivotally mounted at a pivot 98B to a mounting ring 100, which is itself secured to (or in some embodiments formed as part of) the adjustment sleeve 87.

When assembled and when in use, the actuator 88 is disposed outside of a guard or cover screen or mesh 55 (FIG. 3). As is apparent from FIG. 3, the actuator enables a one-point adjustment operation which is well away from any of the moving parts of the pump. As shown in FIG. 6, an adjustment

of the actuator **88** can be made by using a mechanical tool **105** which is shown in the form of a spanner to adjust the stud **89** and the nuts **91, 92**, where the adjustment can be made from a "safe" position outside of the guard or cover **55**.

Optimum operation of the seal assembly **80** requires that the adjusting sleeve **87**, along with the wear face of the static ring seal **84**, be tensioned against the face of rotatable ring seal **81** evenly in both the axial X-X direction (parallel to the shaft or gland sleeve **82**) and in a plane perpendicular to the drive shaft **52**. The contact surface between the rotatable ring seal member **81** and the static ring seal **84** is cooled and lubricated by a small leakage of process fluid. In normal operation, the seal assembly **80** must be set up to operate with, and maintain only, a small leakage. Failure to do so will result in the sealing surfaces overheating and damage occurring to the seal components. The small amount of leaking fluid which passes between the rotatable face seal **81** and the static wearing face seal **84** in use then passes along the annular gap between the shaft or gland sleeve **82** and the adjustment sleeve **87** before being expelled from the rear of the pump housing **30**.

The operational adjustment requirement required for the forked member **95** and the adjustment sleeve **87** which is attached to it, is normally very small, at around a maximum of 2-3 mm axially in order to reduce/increase leakage and to take up any wear in the components of the seal assembly **80** over a period of time. The adjustment sleeve **87** is moved generally inwardly toward the pump housing **30** as shown by the arrows in FIG. 4, and a constant gland sealing is maintained between (i) the adjustment sleeve **87** and the gland seal **78** (which extends from the seal housing **90**), and (ii) between the adjustment sleeve **87**/static ring seal **84** and the gland sleeve **82**/rotatable ring seal **81**.

Due to internal wear there is also a requirement over a period of use for axial adjustment of the impeller **60** within the pump casing **30** in a direction toward the front liner (throatbush) **48**, so that in fact the full movement required for the gland adjustment sleeve **87** may be up to 10 mm. Thus, for operation of the seal assembly **80** via the adjustment mechanism **85**, there can be a coarse adjustment for set up, followed by a self-aligning single-point fine (or "operational") adjustment. To effect a coarse operational adjustment the position of the stud **89** and the nuts **91, 92** can initially locate the forked member **95** in a particular position. Fine adjustment later during operation can then be effected by rotation of the stud **89**, or release of the nuts **91, 92** and repositioning of the forked member **95** and retightening of the nuts **91, 92** so as to touch the forked member **95**. The forked member **95** acts on the adjustment sleeve **87** with two points of contact **98B** on its centreline X-X to provide the axial tension, and the adjustment sleeve **87** is centralized as it passes through the close tolerance of the gland cover. As described earlier, the adjustment sleeve **87** has a (or is fitted with a separate) circumferential mounting ring **100** which allows the adjustment sleeve **87** and associated static ring seal **84** to be slid forwards in the direction of the arrows shown in FIG. 4, and brought into contact with the rotatable ring seal **81** (coarse adjustment). The mounting ring **100** can then be locked off, and the movement of the fork member **95** can then be used for fine/operational adjustment.

The pivotal mounting arrangement of the forked member **95** at the pivot points **98A** and **98B** is especially useful for allowing the "fine tuning" operational adjustment to occur during use of the pump to which the seal assembly **80** is fitted. The pivot points **98A, 98B** are each arranged in a line transverse to the axis of the adjustment sleeve **87**, and thus can provide a centering effect for any axial movement of that

sleeve **87**, which is important so that the seal faces **81, 84** are aligned parallel. This in turn provides better control of the small leakage of process fluid therebetween during use of the pump. The use of pivots (such as rotatable rods, pins or studs) allows virtually friction-free tilting movement of the forked member **95** to cause the said axial movement of the sleeve **87**. The use of a forked member **95** means that the axial movement of the mounting ring **100**/adjustment sleeve **87** is evenly controlled from opposing sides thereof. The forked member **95** functions like a saddle to provide an even spread of displacement force on either side of the sleeve **87**.

Referring now in particular to FIGS. 7 to 10 there is shown a discharge apparatus **108** for use with a pump housing **30**. The discharge apparatus **108** includes an adaptor **70** which comprises a rigid main body **112** (normally made in one piece and of metal) with a discharge passageway or port **111** therein extending from a first end **113** to a second end **114**. The first end **113** is arranged to align with the discharge outlet **56** portion of the pump housing **30**. A mounting flange **120** is provided at the first end **113** which is adapted to be fitted to a cooperating flange **125, 126** which is located on the pump outer casing side parts **33, 34** respectively. The second end **114** is adapted to be mounted to adjacent pipework **200** by means of a flange component **116**. The flange component **116** may comprise two parts **117, 118** which are mirror images of one another and are secured together by bolts **119**. The flange component **116** is separate from the adaptor main body **112** and is arranged to secure an inner liner **138** in position as described hereinafter. The discharge passageway or port **111** may be frusto conical in shape, as is the external side wall **115** of the main body **112**.

As best seen in FIGS. 7, 8 and 9, the flange **120** includes a first section **122** which is generally at right angles to the axis of the pump discharge passageway **111** and which is adapted to be bolted to the flange **125** on the side part **33** (frame plate). The flange **120** also includes a second section **124** which is inclined with respect to the first section **122** and cooperates with a similarly inclined flange **126** on the pump casing side part (cover plate) **34**. Some bolts **130** are used to secure the flanges **122/125** together and also to secure the flanges **124/126** together. There are four bolts **130**, one located at each corner of the two flanges **122, 124**. Only one bolt **130** is actually shown in the Figures. Another bolt **130** is received in a bolt hole **131** during use.

The discharge apparatus **108** further includes a displacement device **132** which is operable to cause displacement between the adaptor **70** and the pump discharge outlet portion **56**. The device **132** comprises a series of threaded bolts **133** which are received within respective threaded apertures **135**, and which when rotated, act on the discharge outlet portion **56** to displace the adaptor **70** therefrom. The threaded apertures **135** are formed in the first section **122** of the flange **120**. When the bolts **133** are in the threaded apertures **135**, rotation of the bolts **133** will cause the free end of the threaded shank of the said bolts **133** to react against the uppermost face of the discharge outlet flange **125** to thereby force the discharge outlet portion **56** and the adaptor **70** apart. FIG. 8 illustrates the adaptor **70** firmly bolted to the discharge outlet portion **56**. FIG. 9 illustrates the two parts **56, 70** displaced apart from one another. As shown in FIG. 9, there is a gap **140** located between the two parts. In the displaced position, the casing side part **34** can be readily removed.

In some further embodiments, the displacement device **132** may not be necessary. The inclination of the second flange section **124** and the flange **126** which is formed on casing side part **34** can enable the side part (front cover plate) **34** to be removed from the front region of the pump casing **30**. In both

cases the side part (front cover plate) **34** can be removed without requiring the pipework **200** to be disassembled from the casing side part (frame plate) **33**. In the embodiment shown the inclination of the second flange is of the order of ten (10) angle degrees, although angles of as little as five (5) or as much as 40 angle degrees are acceptable from the point of view of being able to slidably release and remove the front cover plate **34**.

The drawings show a displacement device where the bolts **133** cooperate with threaded apertures in the first section **122** of the flange **120**. In another embodiment, the bolts **133** could be arranged to cooperate with threaded apertures which are located in the flange **125** on the pump casing side part (frame plate) **33**, so as to act to cause relative movement between the first section **122** of flange **120** by moving it upwardly and away from the flange **125**.

As mentioned earlier the adaptor **70** further includes a replaceable liner **138** which is receivable within the discharge passageway **111**. The liner **138** is held captive or clamped within the discharge passageway **111** by means of the flange component **116**. The adaptor **70** is arranged so as to be able to receive different liners of many different internal bore configurations, as shown in FIG. **10**.

When fully installed, the adaptor **70** is disposed between the pump discharge outlet portion **56** and the adjacent pipework **200**. The flange section **122** is bolted to the flange **125** of the discharge outlet **56** on side casing part (frame plate) **33** by means of bolts **130**. The lowermost in use flange section **124** of the adaptor **70** is bolted to the flange **126** of the discharge outlet **56** at the front side casing part (cover plate) **34**. The activation of bolts **133** on the flange section **122** of the adaptor **70** causes upwards displacement of the adaptor **70** relative to the pump discharge outlet portion **56**. When displaced, there is a gap **140** between the components which facilitates ready removal of only the side casing part (front cover plate) **34**, as shown in FIG. **7**. Access and removal of the side casing part (front cover plate) **34** is improved by having the inclined flange section **124** because the combination of these features means that the upward displacement of adaptor **70** relative to the pump discharge outlet portion **56** need not be a very great distance before the side casing part (front cover plate) **34** becomes releasable and removable. A small amount of such vertical separation is desirable to break any seal which might have formed by a joint gasket which has deteriorated, or to fracture any particulate deposits or scaling which may have built up inside the pump and between the various components.

The arrangements that have been described above enable the replacement of some pump components without the need for removal of the adjacent pipework, and this allows rapid dismantling and removal of all wearing components from the pump. This gives a clear benefit in terms of down time improvement for the end user. A further feature is that the apparatus provides for the fitment of loose liners in combination with alternative port sizes, to provide a smooth transition of flow from the pump to the associated pipework, as shown in FIG. **10**.

The discharge adaptor **70** is a rigid cast component which forms part of the pump casing and allows all wearing and service components to be removed from the pump whilst the discharge pipe is still connected thereto. Built-in jacking screws allow the pipework to be loosened and "jacked" to create a gap sufficient to allow for the removal of the remaining wear component and the rear casing liner.

In the foregoing description of preferred embodiments, specific terminology has been resorted to for the sake of clarity. However, the invention is not intended to be limited to

the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar technical purpose. Terms such as "front" and "rear", "above" and "below" and the like are used as words of convenience to provide reference points and are not to be construed as limiting terms.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgement or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

Finally, it is to be understood that various alterations, modifications and/or additions may be incorporated into the various constructions and arrangements of parts without departing from the spirit or ambit of the invention.

The invention claimed is:

1. An adjustment mechanism for a seal assembly for a pump drive shaft of a pump, the pump shaft mounted for rotation about a rotation axis, the seal assembly including a rotatable seal mounted for rotation with the drive shaft about the rotation axis, and a static seal adjacent the rotatable seal and axially moveable relative thereto, the adjustment mechanism comprising:

an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, an actuator which is operable at a single point and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member at two or more spaced apart couplings whereby activation of the actuator causes simultaneous transmission of the motive force to the couplings.

2. The adjustment mechanism according to claim **1**, wherein the transmission comprises a fork shaped member having two spaced apart legs extending away from one end of the fork shaped member, the free end of each of the legs being pivotally connected to a respective one of the two spaced apart couplings, the member being mounted for pivotal movement in a region between the end of the fork shaped member and the free ends of the spaced apart legs, the one end of the fork shaped member being associated with the actuator.

3. The adjustment mechanism according to claim **1** wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

4. The adjustment mechanism according to claim **2**, wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

5. The adjustment mechanism according to claim **1**, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

6. The adjustment mechanism according to claim **2**, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

7. The adjustment mechanism according to claim **3**, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the

arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

8. The adjustment mechanism according to claim 4, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

9. A seal assembly for a pump drive shaft of a pump, the seal assembly including a rotatable seal mounted for rotation with the pump drive shaft about a rotation axis, and a static seal adjacent the rotatable seal and axially moveable relative thereto, the seal assembly including a housing having a seal chamber therein arranged so that when fitted the pump drive shaft extends through a pump chamber and an adjustment mechanism comprising:

an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, an actuator which is operable at a single point and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member at two or more spaced apart couplings whereby activation of the actuator causes simultaneous transmission of the motive force to the couplings, and

wherein the rotatable and static seal being disposed within said seal chamber and the adjustment member being at least partially received within the pump chamber.

10. A method for adjusting a seal assembly, the seal assembly for a pump drive shaft of a pump, the seal assembly including a rotatable seal mounted for rotation with the pump drive shaft about a rotation axis, and a static seal adjacent the rotatable seal and axially moveable relative thereto, the seal assembly including a housing having a seal chamber therein arranged so that when fitted the pump drive shaft extends through a pump chamber and an adjustment mechanism comprising:

an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, an actuator which is operable at a single point and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member at two or more spaced apart couplings whereby activation of the actuator causes simultaneous transmission of the motive force to the couplings, and

wherein the rotatable and static seal being disposed within said seal chamber and

the adjustment member being at least partially received within the pump chamber; the method comprising:

activating the actuator to cause relative movement between the rotatable seal and the static seal.

11. The method of adjusting a seal assembly according to claim 10, wherein activating the actuator includes:

activating the actuator to effect a course adjustment to cause relative movement between the rotatable seal and the static seal; and

activating the actuator to effect a fine adjustment to cause relative movement between the rotatable seal and the static seal.

12. An adjustment mechanism for a seal assembly for a pump drive shaft of a pump, the pump shaft mounted for rotation about a rotation axis, the seal assembly including a

rotatable seal mounted for rotation with the drive shaft about the rotation axis, and a static seal adjacent the rotatable seal and axially moveable relative thereto, the adjustment mechanism comprising:

an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, the adjustment member including an adjustment sleeve, which is mounted substantially coaxially with respect to the drive shaft in an assembled position and axially movable relative thereto, the static seal being operatively mounted to one end of the adjustment sleeve, an actuator and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member at two or more spaced apart couplings the adjustment mechanism further including a mounting member secured to the other end of the adjustment sleeve, the spaced apart couplings being on the mounting member whereby activation of the actuator causes simultaneous transmission of the motive force to the couplings.

13. The adjustment mechanism according to claim 12, wherein the actuator is operable from a single point.

14. The adjustment mechanism according to claim 12, wherein the mounting member comprises a ring secured to the other end of the adjustment sleeve.

15. The adjustment mechanism according to claim 14, wherein the spaced apart couplings are pivot mountings disposed at opposite sides of the adjustment sleeve.

16. The adjustment mechanism according to claim 12, wherein the transmission comprises a fork shaped member having two spaced apart legs extending away from one end of the fork shaped member, the free end of each of the legs being pivotally connected to a respective one of the two spaced apart couplings, the member being mounted for pivotal movement in a region between the end of the fork shaped member and the free ends of the spaced apart legs, the one end of the fork shaped member being associated with the actuator.

17. The adjustment mechanism according to claim 12, wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

18. The adjustment mechanism according to claim 13, wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

19. The adjustment mechanism according to claim 14, wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

20. The adjustment mechanism according to claim 15, wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

21. The adjustment mechanism according to claim 16, wherein, when fitted, the actuator is spaced from the drive shaft and external of all pump parts.

22. The adjustment mechanism according to claim 12, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

23. The adjustment mechanism according to claim 13, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

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24. The adjustment mechanism according to claim 14, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

25. The adjustment mechanism according to claim 15, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

26. The adjustment mechanism according to claim 16, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

27. The adjustment mechanism according to claim 17, wherein said actuator comprises a stud mounted to the pump and one or more bolts threadably received on the stud, the

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arrangement being such that rotation of the or each bolt causes the transmission to deflect the transmission of the motive force.

28. An adjustment mechanism for a seal assembly for a pump drive shaft of a pump, the pump shaft mounted for rotation about a rotation axis, an access zone for providing access to the seal assembly and a guard at least partially surrounding the access zone, the seal assembly including a rotatable seal mounted for rotation with the drive shaft about the rotation axis and a static seal adjacent the rotatable seal and axially moveable relative thereto, the adjustment mechanism comprising:

an adjustment member which is axially moveable so as to cause axial movement of the static seal relative to the rotatable seal, an actuator and a transmission for transmitting a motive force from the actuator to the adjustment member as a result of activation of the actuator, the transmission being operatively connected to the adjustment member whereby activation of the actuator causes simultaneous transmission of the motive force to the adjustment member, the actuator being spaced from the drive shaft and external of the guard when fitted.

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